Information, Motivation and Behavioral Skills as Mediators Between Sexual Minority Stigma and Condomless anal Sex Among Black South African Men Who have Sex with Men

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Abstract

We assessed pathways between sexual minority stigma and condomless anal intercourse (CAI) among two samples of Black South African men who have sex with other men (MSM). Two cross-sectional surveys were conducted in Tshwane, South Africa; one among 199 Black MSM and another among 480 Black MSM. Men reported on external and internalized experiences of sexual minority stigma, mental health, alcohol use, information-motivation-behavioral skills (IMB) model constructs, and CAI. Structural equation modeling was used to test whether external and internalized stigma were directly and indirectly associated with CAI. In both studies, external stigma and internalized stigma were associated with CAI through IMB model constructs. These results suggest a pathway through which stigma contributes to HIV risk. For HIV prevention efforts to be effective, strengthening safer sex motivation and thus decreasing sexual risk behavior likely requires reducing sexual minority stigma that MSM experience and internalize.

Keywords: Stigma · Men who have sex with men · HIV · Mental health · Alcohol

Introduction

Sexual minority stigma [1, 2], includes both external acts of discrimination enacted upon individuals who engage in same-sex sexuality (i.e. external stigma) and the internalization of one's stigmatized status [3]. Internalized stigma refers to the negative feelings and thoughts about one's sexual orientation among individuals who experience same-sex sexuality. Often described as internalized homophobia, internalized stigma includes additional dimensions, such as confusion about one's sexual orientation [4,5,6,7,8,9,10,11].

Sexual minority stigma has been shown to have numerous negative health consequences, including mental health problems, physical health problems, problems related to substance use, and sexual risk behavior [12,13,14,15]. In sub-Saharan Africa, where same-sex sexuality is highly stigmatized and frequently criminalized [16, 17], the impacts of sexual minority stigma are likely more pronounced than in most high-income countries. Understanding the negative consequences of sexual minority stigma in sub-Saharan Africa is also critical because gay, bisexual and other men who have sex with men (MSM) in sub-Saharan Africa are profoundly affected by HIV [18,19,20,21], including in South Africa [22,23,24,25]. Research has also shown that a large portion of Black South African MSM have low levels of safer sex motivation [26, 27], and that sexual risk behavior (e.g., condomless anal intercourse [CAI]) is common [26,27,28,29,30,31]. Consequently, it is of interest to understand how sexual minority stigma in sub-Saharan African settings contributes to the spread of HIV, particularly via CAI.

Associations between sexual minority stigma and increased sexual risk behavior have been previously reported among MSM in sub-Saharan Africa [32,33,34,35,36,37,38,39]. Little is known, though, about the mechanisms through which sexual minority stigma increases sexual risk behavior. One study conducted among Black South African MSM found that an association between sexual minority stigma and sexual risk behavior was mediated by other psychosocial variables (depression and self-efficacy) [40]. The authors concluded that simply exploring direct associations between stigma and sexual risk behavior has the potential to leave important degrees of complexity unexamined. A subsequent study among 125 Black South African MSM living in townships found that two types of external stigma (personal and institutional) were directly associated with CAI, and that the relationship was not mediated by problem drinking or marijuana use [41].

The current study will further this research by exploring additional potential pathways from sexual minority stigma (both external and internalized) to CAI among two populations of Black South African MSM from the greater Pretoria metropolitan area (Tshwane). The potential pathways from external and internalized stigma to CAI that will be explored are shown in Fig. 1. We hypothesized that external and internalized stigma would have a negative impact on mental health, including alcohol use, which would subsequently decrease a person's motivation and skills to use condoms. These hypotheses are based on previous research suggesting the inter-connectedness of these socio-cultural mechanisms with sexual minority stigma and HIV risk behavior among MSM in sub-Saharan Africa [42]. The behavioral model we selected for this study is the information-motivation-behavioral skills (IMB) model, one of the most comprehensive and adaptable models available for understanding HIV risk behaviors [43,44,45,46,47,48]. The IMB model posits that information, motivation, and
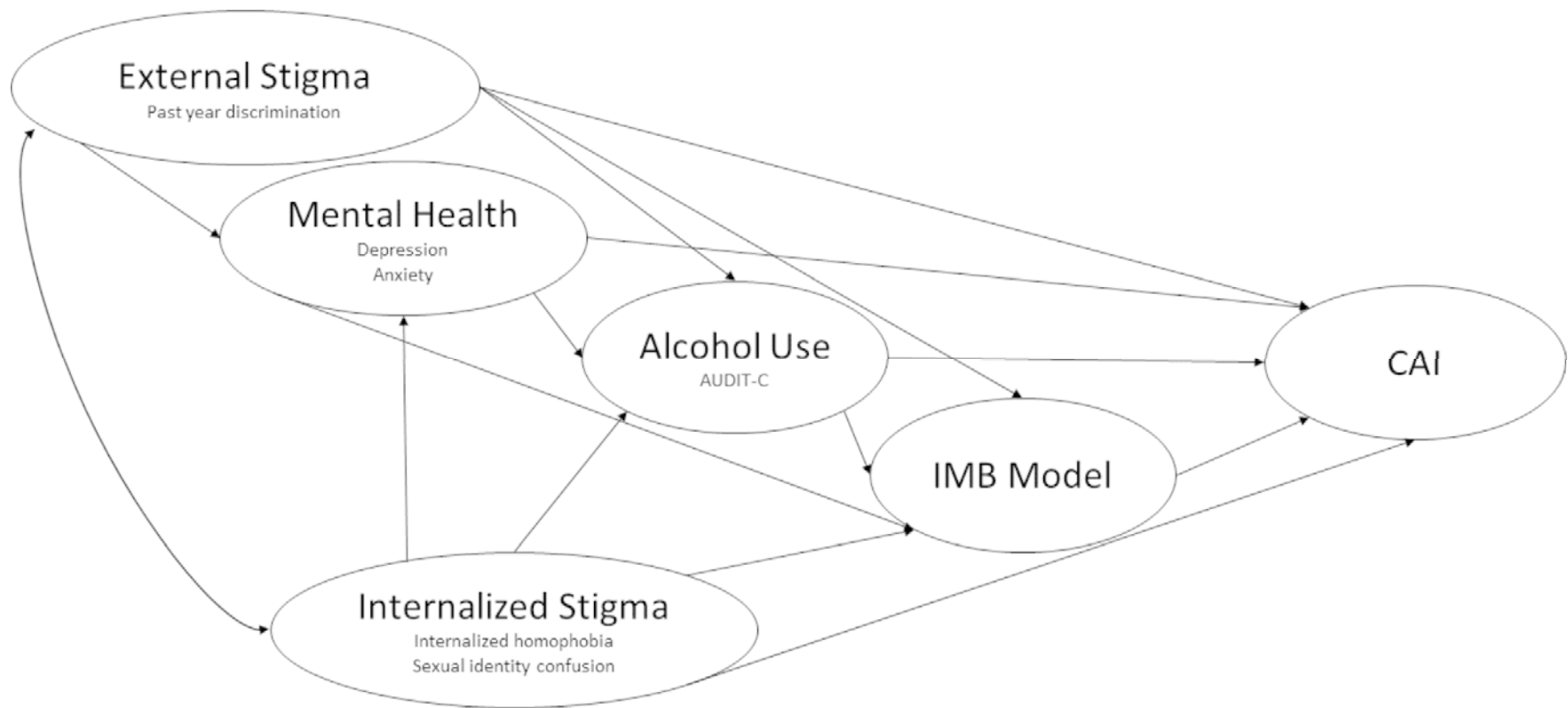
Fig. 1. Direct and indirect pathways from sexual minority stigma to CAI among Black South African men who have sex with men

behavioral skills are the most proximal factors influencing sexual risk behavior. Distal factors, such as sexual minority stigma, mental health issues, or alcohol use, potentially impact sexual risk behavior via IMB constructs as they pertain to safer sex. These constructs might lower safer sex behavioral change, which, in turn, increases HIV risk behavior, or they might impact HIV risk behavior directly (or through each other). In the current study, we elected to treat the IMB model as a unified, albeit multi-dimensional construct. Support for this approach is provided by previous studies showing the complexity of inter-relationships of IMB constructs as they relate to HIV prevention among Black sexual minority men in the US [49], as well as other research showing that distal factors operated through multiple IMB constructs in order to impact condom use among MSM in China [50]. Structural equation modeling (SEM) was used to explore these relationships because it allows for tests of complex, theory-based hypotheses about associations among multi-dimensional constructs, accounting both for measurement error and model fit [51].

The study's context is exceptional for sub-Saharan Africa in that South Africa decriminalized male homosexuality in 1994, outlawed discrimination on the basis of sexual orientation in its 1996 Constitution, and legally recognized same-sex marriages in 2006. In most other African countries, homosexuality remains illegal. Despite these legal protections, Black South African MSM, particularly those residing in townships, face high levels of stigma and related marginalization [52]. For example, in the South African Social Attitudes Survey of 2007, more than 80% of the general population said that homosexuality was "always wrong"—and young people aged 15–24 were only slightly more tolerant than those over 50 years of age (80% v. 85% "always wrong") [53]. Although, accepting attitudes towards same-sex sexuality appear to be increasing in sub-Saharan Africa, generally [54], and in South Africa. For example, in South Africa, two-thirds of people support keeping the present protections against discrimination on the grounds of sexual orientation in the South African Constitution. There has also been a ten-fold increase in the proportion of South Africans who strongly agree with continuing to allow same-sex marriage (from 1 to 10%) over the past ten years [55]. These improvements, notwithstanding, Black South African MSM experience stigma in their everyday interactions with family members and other members of the communities in which they live, including with public officials, such as police and health care workers. This sexual minority stigma is experienced in addition to the racial discrimination that these men also face as Black South Africans.

Methods

Study Participants

Two studies were included (heretofore, Study 1 and Study 2). Study 1, which has been described previously [28,29,30,31, 56, 57], was conducted among 199 Black, English-conversant men living in the greater Pretoria metropolitan area between 18 and 40 years of age who had oral, anal, or masturbatory sex with at least one man in the preceding year, regardless of involvement with women, including men who self-identify as gay. Trained fieldworkers informed potential participants at the various locations about the study and obtained verbal consent. Once consented, all participants were asked to fill out questionnaires using Computer-Assisted Self-Interviewing in order to minimize social desirability bias. Privacy was maintained by having participants complete the survey in quiet,

usually adjacent rooms. Participants were compensated financially for their time. Participant recruitment and data collection were conducted from October to December 2008. All study procedures were approved by the Institutional Review Board of New York State Psychiatric Institute in the U.S. and the Research Ethics Committee of the Human Sciences Research Council in South Africa.

Study 2, which has also been described previously [24, 26, 27, 58], was conducted among 480 Black MSM living in the greater Pretoria metropolitan area between 18 and 44 years of age who had oral, anal, or masturbatory sex with at least one man in the preceding year, regardless of involvement with women, including men who self-identify as gay. Participants were recruited using respondent-driven sampling (RDS) in 18 waves. Once consented, all participants completed a 90-minute interviewer-administered computer-assisted personal interview. All participants were also offered HIV testing, to which all consented. All interviews were conducted in a private space, either the office of the Human Sciences Research Council in central Pretoria or in one of the surrounding townships, e.g., in a community health center, at the participant's choice. Research staff involved in screening, interviewing, HIV testing, and instruction for participant recruitment were trained in a three-day session. All study participants received gift cards to be redeemed for purchase of products at a supermarket as primary incentive for their own participation, as well as an additional gift card for each successful referral to the study. Participant recruitment and data collection were conducted from August 2011 to January 2013. All study procedures were approved by the Institutional Review Board of New York State Psychiatric Institute in the U.S. and the Research Ethics Committee of the Human Sciences Research Council in South Africa.

Measures

The latent constructs estimated for these analyses are compromised of the relevant measures that we describe in further detail below by study.

Study 1

For an overview of the instruments used to estimate the latent variables in the hypothesized model, scale characteristics, items, and psychometric properties from Study 1, see Supplementary Table I.

Primary Explanatory Variables

External stigma against same-sex sexuality was assessed using recent social discrimination. Recent social discrimination assessed the past year occurrence of nine types of negative experiences in social interactions in relation to being gay or homosexual, such as verbal insults, being assaulted or wounded with a weapon, and sexual harassment. This scale was adapted from surveys instruments designed to assess anti-gay violence and victimization [59,60,61,62,63].

Internalized stigma against same-sex sexuality was assessed using two sub-scales of a multi-dimensional scale assessing sexual minority identity: internalized homophobia and sexual orientation confusion. The items used were adapted from existing instruments [9,10,11, 64, 65], and made relevant for the situation in South Africa. For instance, to make sure that items

were relevant to MSM who do not identify with the label gay, references to being gay were omitted.

Proposed Mediators

Mental health was assessed using two separate measures: symptoms of depression and symptoms of anxiety. Both were assessed using 14 items on depression and anxiety from the 21-item version of the Depression Anxiety Stress Scales (DASS), which has demonstrated reliability and validity in clinical and community-based samples in the United States [66,67,68,69].

Alcohol use over the past year was assessed using the Alcohol Use Disorders Identification Test - Consumption (AUDIT- C), [70, 71], a scale developed and validated by the World Health Organization for international use, including in South Africa [70,71,72], where it has been used in multiple studies [73,74,75]. The AUDIT-C uses 3 items: how often the respondent drinks, how many drinks the respondent consumes in a typical day of drinking, and how frequently the respondent drinks six or more drinks at a time. The AUDIT-C was calculated as a continuous measure reflecting the amount of alcohol a participant consumes, with scores ranging from 0 to 12 [76, 77], as done previously [27].

Constructs from the IMB model [43,44,45,46,47,48], with scales that have successfully been applied in South Africa [78], and other low- and middle-income countries [45, 79] were used to estimate safer sex motivation. 'Attitudes towards condom use' were measured using 4 items that asked how it would be to always use condoms during insertive or receptive anal sex with steady or non-steady partners. Response options ranged from 1 = 'Very awful' to 5 = 'Very nice.' To measure 'condom use self-efficacy' participants were asked to assess their capacity for implementing HIV preventive skills. The measure included 6 items that asked how easy it would be for the respondent to perform certain HIV preventive behaviors, such as talk about condom use with regular/steady partners, get tested for HIV, and not have any insertive or receptive anal sex without a condom. Response options ranged from 1 = 'Very difficult to do' to 5 = 'Very easy to do.' 'Perceived social norm supporting the use of condoms' were measured using 4 items that asked how true it would be that most people who are important to the person think that he should use a condom during insertive or receptive anal sex with a steady or non-steady partner; response options ranged from 1 = 'Very untrue' to 5 = 'Very true.' 'Safer sex intentions' were assessed using 3 items that asked how likely it would be for the respondent to intend to use a condom during insertive anal sex, during receptive anal sex, or to always talk with sexual partners about safer sex; response options ranged from 1 = 'Very unlikely' to 5 = 'Very likely.' HIV knowledge was measured using an adapted 4-item scale [80,81,82], as done previously [30]. It included such questions as: 'Having a shower after sex prevents the spread and infection of HIV, therefore it is not necessary to use condoms' and 'You can tell by looking at someone if they have HIV.' Response options were true, false, or 'do not know'. HIV knowledge scores were calculated as the number of correct answers provided; 'do not know' was coded as incorrect. For all IMB scales, a high score indicates a stronger presence of the construct.

Primary Dependent Variable

CAI was measured as the frequency of insertive and receptive anal intercourse without using condoms in the preceding two months. Assessment of this variable was part of an overall assessment of sexual behavior and was based on the Sexual Practices Assessment Schedule (SPAS). The SPAS is a validated tool with demonstrated test-retest reliability [83, 84], which has been adapted for other studies e.g. [85]. The SPAS tallies absolute counts of number of sexual acts, and includes questions about number of occasions of different sexual acts (e.g., oral, anal; receptive, insertive) with different types of partners (e.g., men, women, regular partners, casual partners), with or without protection. The count variables for CAI were log-transformed prior to analyses due to skewed distributions. The distribution of number of acts of CAI, was positively skewed (Skewness = 1.47, Kurtosis = 1.38) so the logged value of CAI was used.

Study 2

For an overview of the instruments used to estimate the latent variables in the hypothesized model, scale characteristics, items, and psychometric properties from Study 2, see Supplementary Table II.

Sexual orientation confusion, alcohol use, and IMB model constructs (all included scales) were assessed using the exact same measure as in Study 1; they are described above.

Primary Explanatory Variables

External stigma against same-sex sexuality was assessed using a 10-tem scale asking how often in the past year you had experienced such things as verbal insults, threats of physical violence, sexually harassment or rape because people see you as feminine and/or because you are a man who has sex with men; items used a 5-point response scale (0="Never"; 4="Often").

Internal stigma against same-sex sexuality was assessed using: internalized homophobia and sexual orientation confusion (same as described above). Internalized homophobia was assessed using a 7-item sub-scale adapted from the Lesbian, Gay, and Bisexual Identity Scale (LGBIS) [10, 86]. A sample item is: 'I wish I were only sexually attracted to women' and used a 4-point response scale (1="Disagree strongly"; 5="Agree strongly").

Proposed Mediators

Mental health was assessed using the Patient Health Questionnaire-4 (PHQ-4), which measures symptoms of depression and symptoms of anxiety [87, 88]. The symptoms of depression items include: "Over the last 2 weeks, how often have you been troubled by any of the following problems: little interest or pleasure in doing things?" and "Over the last 2 weeks, how often have you been troubled by any of the following problems: feeling down, depressed or hopeless?" Each featured a 5-point response scale (0="Not at all"; 4="Nearly everyday"). Symptoms of anxiety was considered positive if a participant responded 'yes' to the following two yes/no items: "Have you ever in your life had an anxiety attack — suddenly feeling fear or panic?" and "Have you had an anxiety attack in the last 4 weeks?"

Primary Dependent Variable

CAI was measured as the frequency of insertive and receptive anal intercourse without using condoms in the preceding year. Assessment of this variables was also part of an overall assessment of sexual behavior based on the SPAS [83, 84].

Statistical Analyses

There was very little missing data (< 2% for any individual variable included in the analyses) in the two studies, and individuals with missing data were excluded listwise. Missing data was assumed to be missing completely at random. SEM analyses were conducted using Mplus 8 version 1.8.6. We followed a common 2-step procedure: 1st, confirmatory factor analysis to assess the fit of the measurement model and then path analysis with model specification [89]. We used a weighted least squares multivariate estimator using a diagonal weight matrix, with theta parameterization. In the model, exogenous variables (external and internalized stigma) were allowed to covary. To assess model goodness of fit, we examined the comparative fit index (CFI), the Tucker-Lewis index (TLI) and the root mean squared error of approximation (RMSEA). CFI and TLI values above 0.9 and RMSEA values below 0.05 represent a good model fit [90, 91].

Results

Participant Characteristics

Study 1 included 199 Black MSM between 18 and 40 years old (mean age: 27 years). Most men lived in a township (75%); the remaining lived in the city of Pretoria (25%). Less than half (47%) had some post-secondary education, 63% were employed. Most men (81%) self-identified as gay. The sample has been described further previously [29,30,31, 56].

Study 2 included 480 Black MSM between 18 and 40 years old (mean age: 24 years). More than half (57%) lived in a township; the remaining 43% lived in the City of Pretoria. More than half (52%) had some post-secondary education, 35% had a regular income. Most men (70%) self-identified as gay. The sample has been described further previously [24, 27, 58].

Descriptive Findings

In Study 1, participants reported a mean of 1.50 (SD = 2.25) acts of discrimination in the past year, a mean level of internalized homophobia of 2.48 (SD = 2.00), and a mean level of sexual identity confusion of 1.87 (SD = 1.25). The mean depression score was 1.52 (SD = 1.29) and the mean anxiety score was 1.52 (SD = 1.43). The mean AUDIT-C score was 4.86 (SD = 5.00), which a score of 4 is considered above the threshold for hazardous drinking. The mean safer sex attitudes score was 3.98 (SD = 4.50), the mean safer sex norms score was 3.95 (SD = 4.25), the mean safer sex self-efficacy score was 3.12 (SD = 3.17), and the mean safer sex intentions score was 4.12 (SD = 4.33). The mean HIV knowledge score was 3.39 (SD = 1.09). The mean number of insertive and receptive acts of CAI in the preceding 2 months was 4.26 (SD = 11.79).

In Study 2, participants reported a mean of 1.51 (SD = 1.30) acts of discrimination in the past year, a mean level of internalized homophobia of 2.12 (SD = 2.14), and a mean level of sexual identity confusion of 2.04 (SD = 2.00). The mean depression score was 1.49 (SD = 1.00) and 10% of men (n = 48) had an anxiety attack in the past 4 weeks. The mean AUDIT-C score was 4.67 (SD = 5.00). The mean safer sex attitudes, norms self-efficacy and intentions scores were 2.90 (SD = 3.00), 3.18 (SD = 3.00), 2.72 (SD = 2.67), and 3.23 (SD = 3.00), respectively. The mean HIV knowledge score was 4.33 (SD = 0.93). The mean number of insertive and receptive acts of CAI in the preceding year was 11.82 (SD = 42.11).

Measurement Model

In both studies, our measurement model comprised 6 latent factors, including our two primary explanatory variables, our three proposed mediators and our primary dependent variable. In Study 1, the model converged normally with acceptable fit: RMSEA = 0.036 (90% CI: 0.030 − 0.041, probability of RMSEA < 0.05 = 1.00); CFI = 0.96; TLI = 0.95. Standardized factor loadings (λ) were all significant (P < .001). In Study 2, the model also converged normally with acceptable fit: RMSEA =. 045 (90% CI: 0.042 − 0.047, probability of RMSEA < 0.05 = 0.999); CFI = 0.95; TLI = 0.95. Standardized factor loadings (λ) were all significant (P < .001).

Pathways from Sexual Minority Stigma to CAI

Table 1 and Fig. 2 show the direct and indirect pathways from sexual minority stigma to CAI for Study 1. Specifically, the precise indirect effects from sexual minority stigma to CAI are reported in Fig. 2, and the pooled indirect effects are reported in Table 1. The model converged normally with acceptable fit: RMSEA = 0.036 (90% CI: 0.030 − 0.041, probability of RMSEA < 0.05 = 1.00); CFI = 0.96; TLI = 0.95. This model accounted for 72% of the variance in CAI. To summarize: (1) external stigma was associated with CAI through IMB model constructs, with external stigma negatively associated with IMB model constructs (β = − 0.330, p = .020) and IMB model constructs negatively associated with CAI (β = − 0.794, p = .018); (2) internalized stigma was associated with CAI through IMB model constructs, with internalized stigma negatively associated with IMB model constructs (β = − 0.831, p < .001) and IMB model constructs negatively associated with CAI, as mentioned above. External and internalized stigma were both positively associated with mental health issues (β = 0.325, p = .002 and β = 0.475, p < .001, respectively) and external stigma was positively associated with alcohol use (β = 0.287, p = .003). Mental health and alcohol use were not associated with either IMB model constructs or CAI. Also, none of the indirect effects from the primary explanatory variables or the mediators to CAI were significant.

Table 2 and Fig. 3 show the direct and indirect pathways from sexual minority stigma to CAI for Study 2. Specifically, the precise indirect effects from sexual minority stigma to CAI are reported in Fig. 3, and the pooled indirect effects are reported in Table 2. The model converged normally with acceptable fit: RMSEA =. 045 (90% CI: 0.042 − 0.048, probability of RMSEA < 0.05 = 0.999); CFI = 0.95; TLI = 0.95. This model accounted for 63% of the variance in CAI. To summarize: (1) external stigma was associated with CAI through IMB model constructs, with external stigma negatively associated with IMB model constructs (β = − 0.159, p = .024) and IMB model constructs negatively associated with CAI (β = − 0.603, p < .001); (2) internalized stigma was associated with CAI through IMB model constructs, with

Table 1. Standardized *β* from structural equation modeling to test direct, indirect and total effects of *External Stigma and Internalized Stigma* on *Condomless Anal Intercourse (CAI)* among Black South African MSM (*N* = 199)

		Explanatory variables				
		External Stigma	Internal Stigma	Mental Health	Alcohol Use	IMB Model
	Dependent variables					
Direct Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	0.325**	0.475***	—		
	Alcohol Use	0.287**	−0.010	−0.099	—	
	IMB Model	−0.330*	−0.831***	0.213	0.111	—
	CAI[1]	−0.085	−0.619	0.180	0.087	−0.794*
Indirect Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	—	—	—		
	Alcohol Use	−0.032	−0.047	—	—	
	IMB Model	0.098	0.095	−0.011	—	—
	CAI[1]	0.265	0.665	−0.0169	−0.088	—
Total Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	0.325**	0.475***	—		
	Alcohol Use	0.254**	−0.058	−0.099	—	
	IMB Model	−0.232*	−0.736***	0.202	0.111	—
	CAI[1]	0.180**	0.046	0.011	−0.001	−0.794*

R^2 in CAI=72%; RMSEA=0.036 (90% CI: 0.030 −0.041, probability of RMSEA<0.05=1.000); CFI=0.96; TLI=0.95

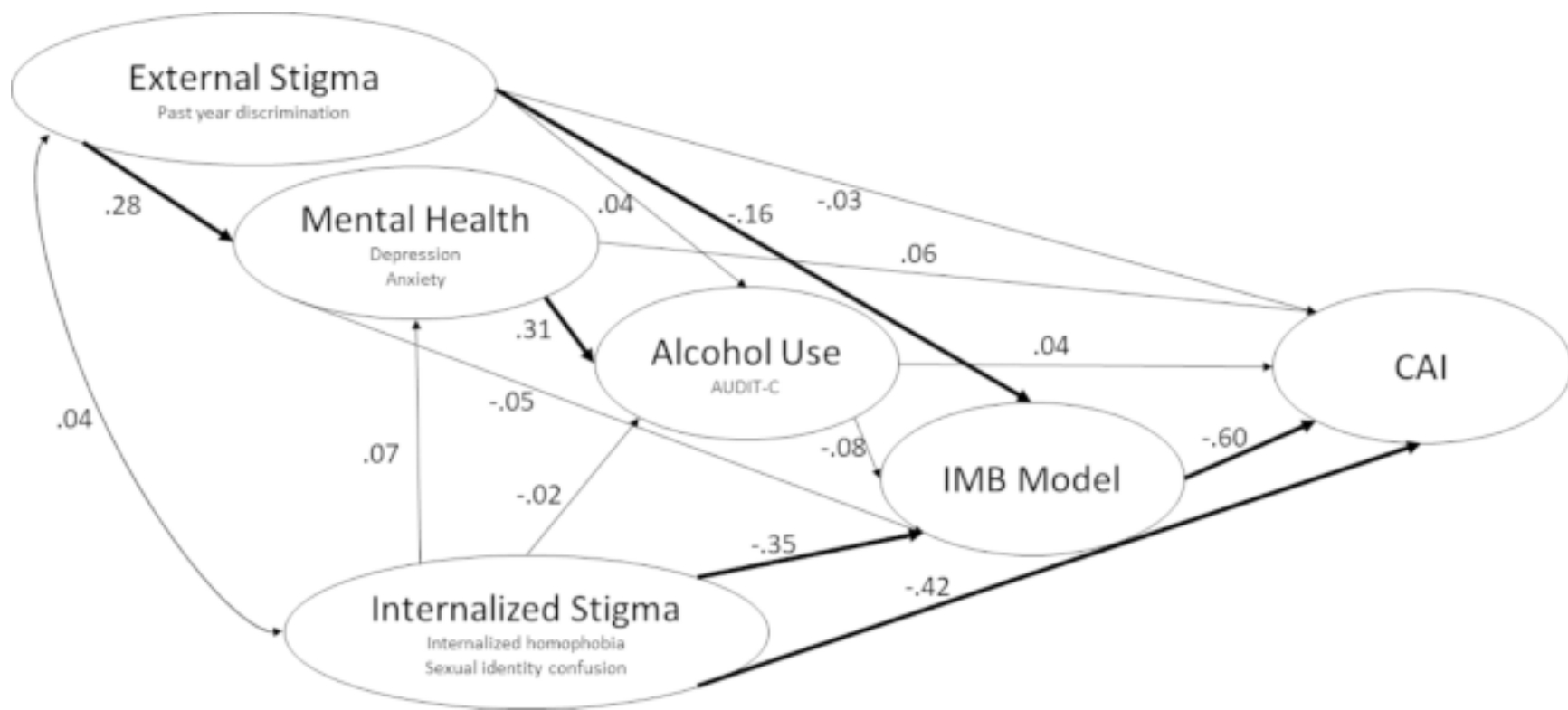* $p<.05$, ** $p<.01$, *** $p<.001$

1. CAI is over the past 2 months

Fig. 3. Estimates of direct and indirect pathways from sexual minority stigma to CAI among a sample of 480 Black men who have sex with men in Tshwane (Pretoria), South Africa

Table 2. Standardized *β* from structural equation modeling to test direct, indirect and total effects of *External Stigma and Internalized Stigma* on *Condomless Anal Intercourse (CAI)* among Black South African MSM (*N* = 480)

		Explanatory variables				
		External Stigma	Internal Stigma	Mental Health	Alcohol Use	IMB Model
	Dependent variables					
Direct Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	0.282***	0.075	—		
	Alcohol Use	−0.044	−0.019	0.306***	—	
	IMB Model	−0.159*	−0.355***	−0.046	−0.077	—
	CAI[1]	−0.031	−0.423***	0.059	0.038	−0.603***
Indirect Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	—	—	—		
	Alcohol Use	0.086**	0.023	—	—	
	IMB Model	−0.016	−0.004	−0.024	—	—
	CAI[1]	0.124**	0.221***	0.054	0.047	—
Total Effects	External Stigma	—				
	Internalized Stigma	—	—			
	Mental Health	0.282***	0.075	—		
	Alcohol Use	0.042	0.004	0.306***	—	
	IMB Model	−0.175**	−0.359***	−0.070	−0.077	—
	CAI[1]	0.093	−0.203***	0.112	0.084	−0.603***

R^2 in CAI=63%; RMSEA=0.045 (90% CI: 0.042 −0.047, probability of RMSEA<0.05 =0.999); CFI=0.95; TLI=0.95

* p<.05, ** p<.01, *** p<.001

1. CAI is over the past year

internalized stigma negatively associated with IMB model constructs ($\beta = -0.355$, $p < .001$) and IMB model constructs negatively associated with CAI, as mentioned above. External stigma was positively associated with mental health issues ($\beta = 0.282$, $p < .001$) and mental health issues were positively associated with alcohol use ($\beta = 0.306$, $p < .001$). Neither mental health nor alcohol use were associated with IMB model constructs nor CAI. Internalized stigma was negatively associated with CAI ($\beta = -0.423$, $p < .001$).

Discussion

In the current study, we used SEM to explore pathways from external and internalized sexual minority stigma to CAI among two samples of Black South African MSM. We observed pathways from sexual minority stigma to CAI in both studies. In both studies, relationships between sexual minority stigma (external and/or internalized) and CAI were mediated by safer sex behavior change based on the results showing significant effects from both externalized and internalized stigma to safer sex behavior change and from safer sex behavior change to CAI in both models. No other constructs mediated a pathway from sexual minority stigma to CAI. In the first study, there was not a significant indirect effect of stigma (external or internalized) on CAI via IMB constructs. In the second study, there was a direct negative association between internalized stigma and CAI.

These findings add to the growing evidence base demonstrating the negative health consequences of sexual minority stigma [12,13,14,15], including its link to increased HIV risk behavior among MSM in sub-Saharan Africa [40, 41]. In both studies, external and internalized stigma were both negatively associated with safer sex behavior change, which was negatively associated with CAI. In this sense, men who experience higher levels of external and/or internalized stigma have lower levels of motivation to practice safer sex, and men with lower levels of motivation to practice safer sex engage in higher levels of CAI. In the second study, there was also a direct negative association between internalized stigma and CAI. This implies that internalized stigma decreases CAI through mechanisms other than those specified in our hypotheses (i.e. not via mental health, alcohol use and/or safer sex behavior change).

In addition to these associations with CAI, external and internalized stigma were both positively associated with mental health issues and alcohol use. In other words, men who experience higher levels of external and internalized stigma have higher levels of mental health issues and have higher levels of alcohol use. However, neither of these constructs were associated with safer sex behavior change or CAI. Generally, the results were consistent across the two studies, even though there were differences in how the samples were recruited and the way that certain constructs were measured.

We also want to consider these findings in light of previous work on mechanisms linking sexual minority stigma to sexual risk behavior [12,13,14,15]. One literature review linking structural, interpersonal and individual experiences of stigma and minority stress among LGBT youth to adverse health consequences, including sexual risk behavior, noted increased vigilance, rumination (a maladaptive emotion regulation strategy characterized by repeated focus on the causes and symptoms of distress), loneliness, and physiologic reactions (e.g. increased cortisol levels or decreased hypothalamic–pituitary–adrenal axis functioning) as potential pathways through which stigma 'gets under the skin' and negatively impacts health

[15]. We did not measure any of these constructs, although perhaps they might have been captured in the direct pathways between stigma and sexual risk behavior that we included in our analyses, for which we did find a significant negative association between internalized stigma and CAI in Study 2. Perhaps, in this context, there are other resilience factors that need to be considered [57, 92, 93]. Also, one of the empirical studies among Black South African MSM explored five iterations of pathways from stigma to sexual risk behavior all of which operated via depression and self-efficacy, but with differing patterns of covariance, found that men who experience more homophobic discrimination are more likely to report depression and lower self-efficacy and more sexual risk behavior [40]. Our findings were that mental health and alcohol use, generally, did not serve as mediators between stigma and sexual risk behavior, which is in disagreement with some of this previous research. Reasons for this might be differences in how the constructs were operationalized, nuances in how MSM cope with gender non-conformity in different contexts, which our research supports [92, 94], as well as differences in sexual behavior. Our previous research supports that the impact of substance use on sexual risk behavior among Black South African MSM is contextual [26, 27]. Otherwise, our findings are generally in concordance with these results, and speak further to the complexity of the relationships between psychosocial factors, and how sexual minority stigma increases vulnerability to HIV infection. The other empirical study among Black South African MSM living in township found that problem drinking nor marijuana use played a role in the association between external stigma CAI [41]. Similarly, our results showed that mental health problems and alcohol use did not mediate association between stigma and CAI, although in both of our samples, safer sex behavior change did.

The current study furthers research on the impact of sexual minority stigma on sexual risk behavior in multiple ways. We explored additional potential pathways linking stigma to sexual risk behavior, providing a more comprehensive understanding of how stigma contributes to negative health consequences. In this regard, the use of SEM allowed us to explore multiple, complex, theory-based hypotheses about the associations among these multi-dimensional constructs, accounting both for measurement error and model fit. This allowed us to identify additional pathways that interventions could target to reduce the negative impact of stigma, as well as strategies that would be less fruitful. Specifically, mental health issues and alcohol use were not identified as important mediators between sexual minority stigma and sexual risk behavior, but safer sex behavior changewas. Thus, decreasing HIV transmission due to the sexual minority stigma that MSM experience could be achieved by strengthening safer sex behavior change. Also, the current study furthers research on this topic in South Africa, an important, middle-income country with the heaviest burden of HIV in the world, including an elevated burden of HIV and risk of transmission among MSM [21, 25].

There are certain limitations to the current study. First, since the data for these studies was collected in 2008 and 2013, there have been advances in the biomedical prevention of HIV transmission, specifically increasing access to HIV pre-exposure prophylaxis (PrEP) and universal ART access in South Africa under updated treatment guidelines, along with increased understanding of treatment as prevention. Future studies should measure sexual risk behavior as more than CAI. Furthermore, it is fair to wonder whether findings from the current study are likely generalizable to MSM in contemporary South Africa. In the context of this project, however, our measure of sexual risk behavior represents behavior that would have been associated with risk of HIV transmission at the time, and thus we believe that these

findings remain relevant even in light of these other advancements in HIV prevention and treatment, although we acknowledge this as a potential limitation. Relatedly, the sexual risk behavior that we considered (CAI: number of acts of unprotected receptive and insertive anal intercourse) could have been even more robust, and included other relevant strategies that could be used at the time, such as serosorting, strategic positioning, or other potential risk reduction strategies. However, it is unlikely that these other strategies would have been common given the limited levels of recent HIV testing in these samples (40% in the Study 1 sample [56], and 35% in the Study 2 sample, with 48% of HIV positive MSM reporting that it was very unlikely or unlikely that they were HIV-infected [26]). CAI was also different across the two studies, with one assessing CAI over the previous 2 months and the other CAI over the past year, which likely hinders comparability between the two studies. Also, the data collected are self-reported and could have been subject to social desirability or recall bias, which would lead to under-reporting, especially of alcohol use or CAI. In addition, the cross-sectional research design limits the ability to infer causality. For example, we assume that stigma influences mental health distress, which influence safer sex behavior change. However, these findings may also reflect that men with higher levels of mental health distress experience higher levels of sexual minority stigma. Also, we combined all elements of the IMB model into a single latent construct, which lacks specificity in terms of the multiple different elements encompassed in this behavior change model. By taking this approach, what is common (i.e., the shared variance) between the many different elements encompassed in this construct is ambiguous. Lastly, while many of our findings were in the expected directions, there were also certain findings that were not in agreement with our expectations. For example, it is not clear why internalized stigma was negatively associated with CAI directly in one study.

In summary, the current study expands the literature by providing further evidence of the negative health consequences of sexual minority stigma, and in a sub-Saharan African setting, where there is heightened concern about HIV and the behaviors that contribute to its disparate impact on vulnerable populations, such as Black MSM. Furthermore, we identified specific pathways through which sexual minority stigma impacted HIV risk behavior; specifically through safer sex behavior change, which is an intervenable factor. The implications of these findings are that strengthening safer sex behavior change and thus decreasing HIV transmission likely requires reducing the sexual minority stigma that MSM experience. These findings should be taken into consideration by efforts aimed at reducing sexual risk behavior and preventing HIV transmission among this critical population, efforts which are urgently needed.

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Contributions

JK wrote the manuscript. BK served as the lead statistician. BK, SS, VR, CD, and TGMS assisted with data interpretation and read drafts of the paper. TGMS served as the principal investigator for the project.

Ethics declarations

Conflicts of Interest/Competing Interests

The authors have no conflicts of interest to declare.

Ethics Approval

All study protocols received ethics approval by the Institutional Review Board of New York State Psychiatric Institute in the U.S. and the Research Ethics Committee of the Human Sciences Research Council in South Africa.

Consent to Participate

All participants provided written informed consent.

Consent for Publication

The authors affirm that all participant signed informed consent regarding publishing their data.

Data Availability

The data underlying the results presented in the study are available upon request from Theo Sandfort, tgs2001@columbia.edu.

Code Availability

The code used to achieve the results presented in the study is available upon request from Bryan Kutner, bak2133@columbia.edu.

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